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10/710,272	06/30/2004	Bruce Bennett Doris	FIS920030389USI	4271

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EXAMINER
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TSAI, H JEY

ART UNIT	PAPER NUMBER
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2812

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/710,272	DORIS ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	H.Jey Tsai	2812	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 16-22 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15, 23-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

In view of Appeal conference held on June 23, 2007, the last Final rejection is withdrawn.

In view of the Appeal Brief filed on April 19, 2007, PROSECUTION IS HEREBY REOPENED. New ground of rejections is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) initiate a new appeal by filing a notice of appeal under 37 CFR 41.31 followed by an appeal brief under 37 CFR 41.37. The previously paid notice of appeal fee and appeal brief fee can be applied to the new appeal. If, however, the appeal fees set forth in 37 CFR 41.20 have been increased since they were previously paid, then appellant must pay the difference between the increased fees and the amount previously paid.

A Supervisory Patent Examiner (SPE) has approved of reopening prosecution by signing below:

  
MICHAEL LEBENTRITT  
SUPERVISORY PATENT EXAMINER

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:  
A person shall be entitled to a patent unless --

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(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 10-11, 14-15, 23-30 are rejected under 35 U.S.C. § 102(e) as being anticipated by Yeo et al. 2004/0173815, newly cited.

Yeo et al. discloses a method of forming an electronic device, comprising:

forming at least one localized stressor region 305a within the device, para. 30-34, 8-15, figs. 3A-3B, or figs. 4A-11D, para. 35-64,

forming a second localized stressor region 305b within the device fig. 2A-2B,

first localized stressor region and said second localized stressor region causing a channel region to be stressed, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

first localized stress-stressor region and said second localized comprise a same type material silicon germanium or silicon carbide, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

the same type material comprises one of a compressive stressor material and a, tensile stressor material, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

device comprises a planar FET (Field Effect Transistor), fig. 3A,

comprises a compressive carriers in said region being stressed the same type material and primary charge comprise holes (carriers), para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

the same type material comprises a tensile material and primary charge carriers in the region being stressed comprise electrons (carriers), para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

the region being stressed causes carrier mobility in the stressed region into one of increased and decreased, relative to a carrier mobility in a region without the stress, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

at least one of localized stressor region 305a, 305b interacts with a stressed region located outside said device, fig. 3A-3B, 8-15 or figs. 4A-11D, para. 35-64,

wherein said at least one localized stressor is used to generate one of a compressive and a tensile stress, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

wherein the at least one localized stressor region is located within the device to generate a Stress that enhances a performance of the device, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

wherein the enhancement comprises an increase in performance enhancement by changing carrier mobility, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

wherein at least one localized stressor region is located to generate a stressed region in at least one of a direction parallel to a current flow and perpendicular to a current flow, figs. 3A-3B, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64,

wherein at least one localized stressor region 3051, 305b or silicide is used to create a symetrically stressed region, para. 30-34, 8-15 or figs. 4A-11D, para. 35-64.

Claims 1-4, 10-11, 14-15, 23-30 are rejected under 35 U.S.C. § 102(e) as being anticipated by Chen et al. 2005/0190421, newly cited.

Chen et al. discloses a method of forming an electronic device, comprising:

forming at least one localized stressor region 911 within the device, para. 44-45,  
36. fig. 9,

forming a second localized stressor region 913 within the device fig. 9,

first localized stressor region and said second localized stressor region causing a  
channel region to be stressed, para. 44-45,

first localized stress-stressor region and said second localized comprise a same  
type material silicide, para. 36. 44-45,

the same type material comprises one of a compressive stressor material and a,  
tensile stressor material, para. 44-45,

comprises a compressive carriers in said region being stressed the same type  
material and primary charge comprise holes (current), para. 44-45,

the same type material comprises a tensile material and primary charge carriers  
in the region being stressed comprise electrons (current), para. 44-45,

the region being stressed causes carrier mobility (current) in the stressed region  
into one of increased and decreased, relative to a carrier mobility in a region without the  
stress, para. 44-45,

at least one of localized stressor region 911, 193 interacts with a stressed region  
located outside said device, fig. 9, para. 44-45,

wherein said at least one localized stressor is used to generate one of a  
compressive and a tensile stress, para. 44-45,

wherein the at least one localized stressor region is located within the device to  
generate a stress that enhances a performance of the device, para. 44-45,

wherein the enhancement comprises an increase in performance enhancement  
by changing carrier mobility (current), para. 44-45,

wherein at least one localized stressor region is located to generate a stressed region in at least one of a direction parallel to a current flow and perpendicular to a current flow, fig. 9, para. 44-45,

wherein at least one localized stressor region 911, 913 or silicide is used to create a symmetrically stressed region, para. 44-45, fig. 9.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-15, 23-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hareland et al. 6,909,151, previously cited, in view of Matsumoto et al. 2004/0227185 or Kumagai et al. 2004/0075148 or Ke et al. 2005/0079677, newly cited.

The reference discloses:

Hareland et al. discloses a method of forming an electronic device, comprising:

forming at least one localized stressor region (stress incorporating layer formed above of beneath the channel region, such as silicon nitride layer 360 or 560 or oxide

layer 319 or Cobalt silicide 430, same material as instant invention) within the device, col. 2, lines 33-67, col. 6, line 28-67, figs. 3-4,

forming a second localized stressor region within the device (layer 360 formed above or beneath or cobalt silicide layer 430 on each source/drain or layer 319 beneath the channel region), fig. 3A, 3B, 4, col. 2, lines 33-67, col. 6, line 28-67, figs. 3-5,

first localized stressor region and said second localized stressor region causing a channel region to be stressed, col. 2, lines 33-67, col. 6, line 28-67, col. 13, lines 1-56, figs. 3-5,

first localized stress-stressor region and said second localized comprise a same type material of SiN or oxide or cobalt silicide, col. 7, lines 1-25, col. 13, lines 1-55,

the same type material comprises one of a compressive stressor material and a, tensile stressor material, col. 2, line 45-57, col. 6, lines 58-67, col. 7, lines 1-25, col. 13, lines 1-55,

device is a FinFET (Fin Field Effect Transistor), fig. 4-5,

forming fin connector 520 to connect the FinFETs and forming a stressor 560, 430, fig. 5E and col. 10, lines 13-67,

first and second localized stressor regions are formed on a source and drain region 430 of the FinFET, fig. 4,

device comprises a planar FET (Field Effect Transistor), fig. 1, 2A,

comprises a compressive carriers in said region being stressed the same type material and primary charge comprise holes (carriers), col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55, col. 7, lines 20-67, col. 13, lines 31-55,

the same type material comprises a tensile material and primary charge carriers in the region being stressed comprise electrons (carriers), col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55.



The region being stressed causes carrier mobility in the stressed region into one of increased and decreased, relative to a carrier mobility in a region without the stress, col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55,

forming a blocking mask, col. 10, lines 36 col. 12, line 35,

at least one of localized stressor region 360 or 560 or 430 interacts with a stressed region located outside said device, fig. 3A, 3B, 5C,

wherein said at least one localized stressor is used to generate one of a compressive and a tensile stress, col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55,

wherein the at least one localized stressor region is located within the device to generate a Stress that enhances a performance of the device, col. 2, lines 33-57, col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55,

wherein the enhancement comprises an increase in performance enhancement by changing carrier mobility, col. 2, lines 33-57, col. 6, lines 30-35, col. 7, lines 20-67, col. 13, lines 31-55,

wherein at least one localized stressor region 360 or 560 is located to generate a stressed region in at least one of a direction parallel to a current flow and perpendicular to a current flow, (stressor formed on top only or side only or bottom only),

wherein at least one localized stressor region 360 or 560 or silicide is used to create a symetrically stressed region (formed on top and bottom),

wherein at least one localized stressor region 360 or 560 or silicide is used to create an asymmetrically stressed region (stressor formed on top only or side only or bottom only).

The difference between the reference(s) and the claims are as follows: Hareland et al. teaches forming localized silicide layer on the source/drain region but does not

teach that cobalt silicide layer having high stress property. However, Matsumoto et al. para. 39 and 80, fig. 19, that cobalt silicide formed as a localized stressor 13 by increasing the stresses in the channel region of the transistor. Kumagai et al. teaches at para. 208-210 and fig. 16, forming a cobalt silicide layer 181, 381 on the source/drain regions as a localized stressor. Ke et al. teaches at para. 23, 31, 33, figs. 5-7, forming localized silicide stressors 708, 709 and dielectric stressors 702a, 702b., 706a, 706b.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have recognized that cobalt silicide increases the stresses in the channel region of the transistor as suggested by Matsumoto et al. or Kumagai et al. or Ke et al. because the stresses enhanced the carrier mobility of the transistor.

Claims 5-9, 13 are rejected under 35 U.S.C 103 as being unpatentable over Yeo et al. as applied to claims 1-4, 10-11, 14-15, 23-30 above, and further in view of Hareland et al. 6,909,151.

The difference between the references applied above and the instant claim(s) is: Yeo et al. teaches forming localized stressors in the source/drain regions but does not teach forming localized stressor in a FinFET device. However, Hareland et al. teaches at figures 3-5, forming FinFET device having localized stressor 430.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by forming localized stressors in the source/drain regions of the FinFET device as taught by Hareland et al. because localized stressors formed in the source/drain regions would induces stresses in the channel region to enhanced the carrier mobility (current) for better device performance.

Claims 5-9, 13 are rejected under 35 U.S.C 103 as being unpatentable over Chen et al. as applied to claims 1-4, 10-11, 14-15, 23-30 above, and further in view of Hareland et al. 6,909,151.

The difference between the references applied above and the instant claim(s) is: Chen et al. teaches forming localized stressors in the source/drain regions but does not teach forming localized stressor in a FinFET device. However, Hareland et al. teaches at figures 3-5, forming FinFET device having localized stressor 430.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above references' teachings by forming localized stressors in the source/drain regions of the FinFET device as taught by Hareland et al. because localized stressors formed in the source/drain regions would induce stresses in the channel region to enhance the carrier mobility (current) for better device performance.

### ***Conclusions***

Applicant's arguments filed April 19, 2007 have been fully considered but they are not persuasive. Because newly cited references teach localized stressors as set forth above. And, Hareland et al. clearly teach forming at least one localized stressor region (stress incorporating layer formed above or beneath the channel region, such as silicon nitride layer 360 or 560 or oxide layer 319 or Cobalt silicide 430, same material as instant invention) within the device, figs. 3-4, forming a second localized stressor region within the device (layer 360 formed above or beneath or cobalt silicide layer 430 on each source/drain or layer 19 beneath the channel region), first localized

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stressor region and said second localized stressor region causing a channel region to be stressed as set forth above. Hareland et al. clearly teaches the meaning of localized stressor that meets the claimed invention at figs.3-4 and col. 6, lines 36-46, a localized stressor layer 360 embedded in the tri-gate FinFET device 300 by depositing around the exposed portion of semiconductor body (fin connector part, see fig. 3A) 308, over and around the gate electrode 324 as well as directly on or adjacent to the sides 310, 312 of semiconductor body 308. Since, device 300 is a tri-gate FinFET transistor (including three gate electrodes and 3 pairs of source/drain regions), hence localized stressor layer 360 is clearly localized within the tri-gate FinFET device 300 and causing a channel region 350 to be stressed (see col. 2, lines 33-67, col. 6, lines 28-67, col. 13, lines 1-56 and figs. 3-5 as set forth in the last Final rejection). Hareland teaches at col. 8, lines 8-20, isolated localized silicide stressor 430 also can be formed on the fin connector region 308 (see col. 8, lines 42-55), an isolated stressor 319 and/or localized stressor 360 formed on the fin connection region (connection part) 308, 520 (see col. 8, lines 42-65, col. 10, lines 13-67, fig. 5E of Hareland. Silicide film stressor 450/430 can form a localized stressor on top of gate electrode 324, 325 see col. 8, lines 56-65 of Hareland.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to H. Jey Tsai whose telephone number is (571) 272-1684. The examiner can normally be reached on from 7:00 Am to 4:00 Pm., Monday thru Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael S. Lebentritt can be reached on (571) 272-1873.

The fax phone number for this Group is 571-273-8300.

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hjt

A handwritten signature in black ink, appearing to read 'H. Jey Tsai', written in a cursive style.

H. Jey Tsai  
Primary Examiner  
Patent Examining Group 2800